Available online at www.ewijst.org

ISSN: 0975-7112 (Print)
ISSN: 0975-7120 (Online)

Environ. We Int. J. Sci. Tech. 8 (2013) 87-96

Environment & We
An International
Journal of Science
& Technology

Ethnomedicinal Uses and Floristic Diversity of Invasive Weeds in Agricultural Fields of Godhra and Baria Forest Division in Gujarat, India

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Abstract

A great chunk of forest department revenue depends on grazing land and plant population. But weeds in the forest areas are the main hindering factor that causes a great deal of damage to forest economy. The ecological problems caused by the invasion of many weeds in open pockets and grazing lands in natural forests have not been given attention by either the academicians or administrators. Hence, a concerted effort was made in the present study to quantify the impact of weeds on the conservation of sustained agro-biodiversity in Godhra and Baria forest divisions of east Gujarat, India. A total of 19 invasive weeds were identified in the study area that are used by the local people for medicinal purposes. The present study collected information related to the baseline floristic and ecological problems and proposed to document the structure and composition of the forest vegetation. Emphasis was also made on ethnomedicinal details to explore the conservation status and folk medicinal knowledge of the surrounding people of the study area. Results of quantitative sampling demonstrated that *Xanthium strumarium* L. species density (7.5) dominated in the Baria forest division while *Solanum incanum* Linn species density (6.4) in the Godhra forest division.

Keywords: Invasive weeds, Ethnomedicinal uses, Floristic diversity, Forest Division

Introduction

Human history on this planet will never be completed without a look at the role of plants. A complete record of many thousands of the plant species used by human being during past shows their importance in health, economy, shelter, clothing and food (Rizwana *et al.,* 2006). Regional floristic surveys are required to know the species range, floristic variability, economic value and assess the conservation status

of community in any area (Sundriyal *et al*., 2003; Chandra and Rao 2007; Chandra *et al*., 2009). Over last two decades, the species area relations, environmental gradient, natural features, distribution pattern of the specific taxa and bio-geographic region are considered the best criteria for declaring and management of the world forest (Diamond *et al*., 1995). One of the most critical issues on the national and global agenda is need to preserve biodiversity for future generations while trying to understand and document the ethnomedicinal knowledge of resource management practices (Nehal *et al*., 2004).

In the contemporary world, biological invasions represent a major contributory factor to the global biodiversity crisis (Sala *et al*., 2010; Rashid *et al*., 2009). Thousands of plant species have been and continue to be transported by humans to areas far from their natural habitats (Richardson *et al*., 2003). Some are moved accidentally, but more importantly, many of the species are intentionally introduced and cultivated to serve human needs (Bahuguna *et al*., 2010). The recognition of plants as weeds is perhaps as old as agriculture itself. When land is cultivated to raise crops, weeds spring up naturally along with the crop plants. Weeds are defined as a plant out of place or an unwanted plant or a plant with a negative or plant that competes with man for the soil (Kasera *et al*., 1998). Quite a number of plants considered as weeds in modern sciences have significant value in ethnobotany. Many of these naturally growing plants are not really "unwanted" in the light of traditional herbal medicines (Patnaik *et al*., 1956; Govindiah, 1981).

On the traditional uses of weeds, only little work have been carried out in India (Sharma and Khandelwal, 2010; Patnaik, 1956). Patil and Patil (2010) provided information on some useful weeds grown in the Wastelands of Kadi, Gujarat. About 1400 km^2 area of Gujarat is maintained by the Forest Department as grasslands, of which 1295 km^2 is located in Kutch and Saurashtra region of the State (Rahmani *et al*., 1997).

In Gujarat, grazing requirement was met from fallow land, grassland, wasteland and gauchers (GEC, 1998). These grazing lands are together called as common property resources (CPRs). However, the CPRs were declined from 61.4% to 50% in Gujarat during 1961-62 to 1992-93 (Parikh *et al*., 1997.) The grassland is called in India as anthropogenic or savannah (Rodgers, 1986). Investigation of lantana foliage showed that animals during grazing develop intrahepatic cholestasis and associated liver damage, therefore affects the animal husbandry (Sharma and Sharma, 1989). As such, the present study is intended to document the negative effects of invasion weeds in the CPRs. The phytosociological study conducted focused on two objectives, which attempted: i) to document the ethnomedicinal information of the invasive weeds for medicinal purposes and indigenous knowledge related to traditional health care system for curing ailments. ii) to assess the floristic diversity of the Baria and Godhra forest divisions (in east Gujarat state of India).

Materials and methods:

Study area:

Present study was conducted in Godhra and Baria forest divisions of east Gujarat. Godhra and Baria forest divisions lies between 73^o 8' E to 74^o 29' E longitude and 22^o

14' N to 23^{o} 28' N latitude with dry teak forests of type 4A southern tropical dry mixed deciduous forests and 5/DS1 dry deciduous scrub forest (Figure 1). The Godhra forest consists of 1105.91 sq km area and the Baria forest constitute an area of 880.32 sq km. The study area covers an altitudinal range of 915-1100 meter above sea level (masl).

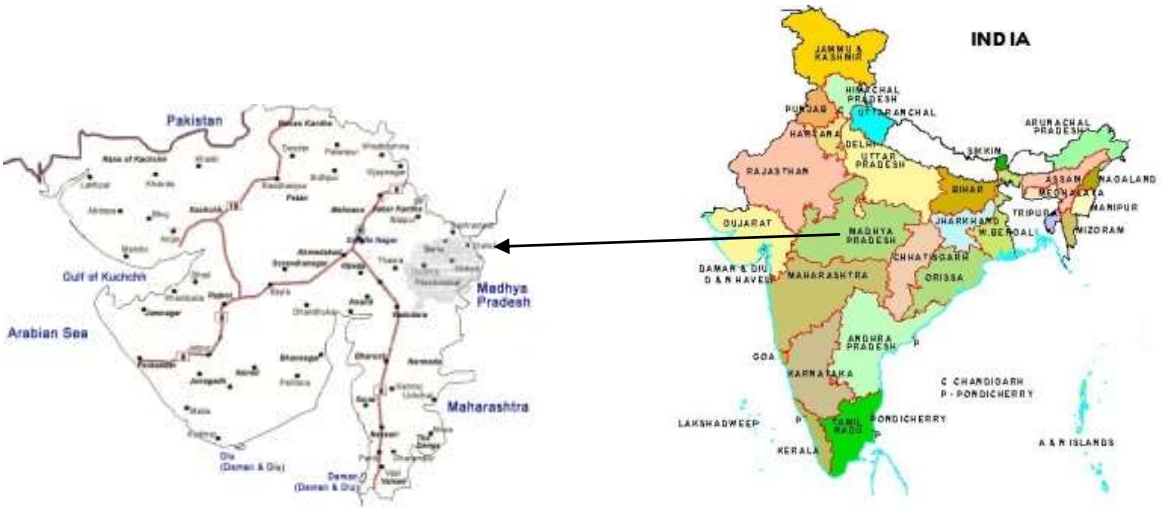

Figure 1 Map of the Godhra and Baria forest division (Study area)

Field Survey

Field survey was carried out and specimens were collected with the help of 'working plan" of Godhra and Baria forest divisions. Plant species were identified with the help of forest department of east Gujarat. Apart from the vegetation study, plant species were collected and herbarium was prepared for identification. A complete and in-depth quantitative field survey was conducted for plant population estimation in the study area. Approximately 10 x 10 m forest stands were selected in the study area and each forest stand of ten quadrates (1 x 1 m size each) was laid randomly following the methodology (Kershaw, 1973). Analytical features of the population such as percent frequency, density, abundance and A/F ratio was calculated using the standard methods (Misra, 1980). The ratio of abundance to frequency (A/F) is a relative measure to present the distribution of species in a community and was calculated as according to the standard methods (Curtis *et al.*, 1956).

Ethnobotanical Survey:

Ethnomedicinal information of local communities was collected using semi-structured and structured questionnaires and schedules. Interviews and group discussions both formal and informal and empirical observations were carried out about the ethnobotanical uses of the weeds in the study area. Field visits were made with local people to gather information on the identity and occurrence of invasive weeds for medicinal purposes and other forms of their utilization. Cross verification of data was repeated through interviews with more than one informant. The information related to medicinal and ethnobotanical usages of weeds in the study area

were obtained from the local medicinal/health practitioners of MAPs and resourceful people.

Results:

The forest composition uses of 19 invasive weeds in both Godhra and Baria forest divisions were carried out. It was observed that out of total weeds, 52.6% of varieties were used in the form of leaves and stem, 31.6% as roots and the remaining 15.8% were used for seed and fruits in both the forest divisions (Figure 2). Most of the weeds, the root part and seed are used. The main dominated species in Godhra forest division was *Parthenium hysterophorus*, *Digera muricata* and *Solanum incanum* having frequency of 90% (Table1). However, the highest density were observed in *Solanum incanum* (6.4 plant/m) followed by *Murraya Koenigii* (4.6 plant/m). A/F ratio was observed highest (0.601) in *Ocimum basilicum* followed by *Capparis decidua* (Table 1).

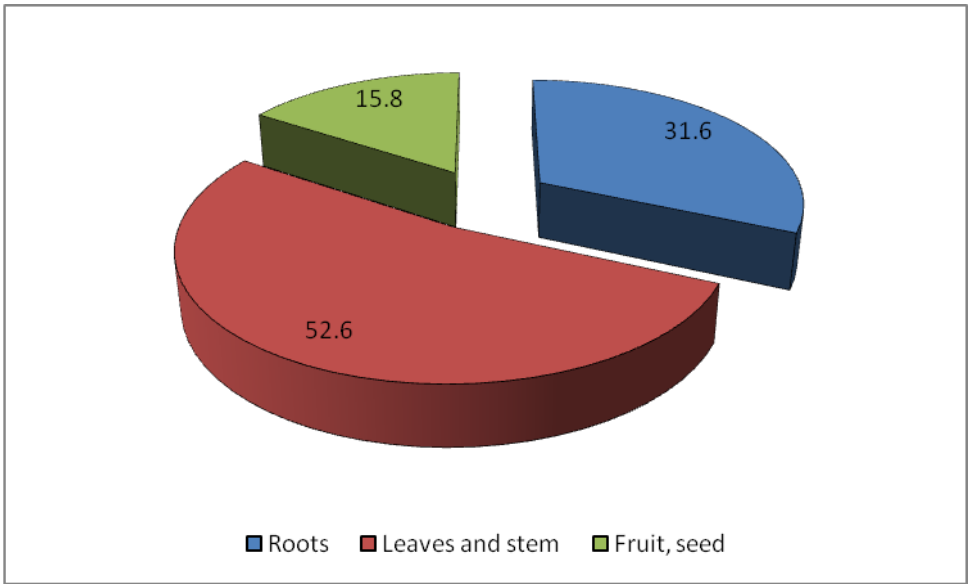

Figure 2. Utilization. Distribution of weed species parts in Godhra and Baria forest division (in percentage).

Table 1 Phytosociological attributes of weeds in Godhra Forest Divison.

S. No	**Name of the species**	**Frequency** (%)	**Density** (Plants m-^{2})	**Abundance**	**A/F ratio**
1	*Cassia tora*	80	3.3	4.12	0.051
2	*Cassia auriculata*	70	1.3	1.3	0.018
3	*Lantana camara*	40	0.5	0.71	0.017
4	*Aristida funiculata*	80	2	2.5	0.031
5	*Capparis decidua*	50	2.4	23.33	0.466
6	*Murraya Koenigii*	70	4.6	27.22	0.388
7	*Ocimum basilicum*	80	3.3	48.14	0.601
8	*Ocimum sanctum*	50	1.1	54.3	1.086
9	*Parthenium hysterophorus*	90	2.1	38.14	0.423
10	*Digera muricata (L.)*	90	4.1	5.12	0.056
11	*Solanum incanum L.*	90	6.4	6.4	0.071

Table 2 Phytosociological attributes of weeds in Baria Forest Divison.

S. No	Name of the species	Frequency (%)	Density (Plants m^{-2})	Abundance	A/F ratio
I	*Indigofera pulchella*	70	4.9	6.13	0.088
2	*Cassia tora*	60	5.8	5.80	0.097
3	*Sorghum halepense*	70	5.6	8.00	0.114
4	*Cassia auriculata*	80	2	2.50	0.031
5	*Lantana camara*	60	3.4	23.33	0.389
6	*Xanthium strumarium*	80	7.5	27.22	0.340
7	*Aristida funiculata*	60	6.1	48.14	0.802
8	*Calotropis gigantea*	90	5.2	54.30	0.603
9	*Capparis decidua*	70	3.9	38.14	0.545
10	*Mimosa pudica L.*	60	2.5	3.13	0.052
11	*Tribulus terrestris L.*	40	0.5	0.50	0.013
12	*Asparagus sarmentosus*	50	0.6	0.86	0.017

In Baria forest division, *Calotropis gigantea* showed (90%) highest frequency followed by (80%) *Xanthium strumarium* and *Cassia auriculata*. The highest density of plant populations was found (5.5 plant/m) in the case of *Xanthium strumarium* followed by *Aristida funiculata* (6.1 plant/m). A/F ratio was recorded highest (0.802) for *Aristida funiculata,* followed by (0.802) in *Calotropis gigantea* (Table 2). It was also observed in the Baria forest division an abundance of dominated weeds and unpalatable species ie., *Cassia tora* and *Lantana camara* in patches indicating high grazing pressure of livestock. The ethnobotanical studies further reveal that all these weeds are also used by the local forest dwellers/villagers for different ailments in their daily life (Table 3). It was observed that most of the weeds were used for stomach disorders and skin diseases.

Discussion:

The data on the abundance, density and frequency ratio showed that all the species recorded contagious distribution pattern (Table 1, 2). Contagious distribution is common in nature (Kandari *et al*., 2011) and. most pervasive pattern that may depend on the local habitat, daily and seasonal weather change and reproductive process (Curtis and Cottom, 1956). The number of species of trees, herbs, shrubs and sapling indicate that these forest stands are comparatively dominated by the invasive weeds. High percentage of herbs in the area could be attributed to edaphic and climate factors like rainfall and temperatures (Dabgar *et al*., 2010; Dabgar and Kumbhar, 2010). Although a number of species shared dominance, no single species was found to complete climax species.

The *Calotropis gigantea* and *Cassia tora* were found to be more adaptive and survive in adverse seasonal conditions in the form of seeds. They are found predominantly in extreme dry and hot conditions in both the divisions. Due to heavy grazing pressure, production in many grassland areas are less and dominated by weeds (Gandhi *et al*., 2011). Dominance of *Calotropis gigantea* and *Cassia tora* in revenue region to biotic interference includes over grazing, deforestation, intensive utilization of land for cultivation and increase in human habitation. This is an

Table 3. Invasive weeds used in medicinal purposes by the local people of Panchmahal forest division in Gujarat, India.

S. No	Name of the species	Family	Varnacular name	Ailments	Method of dosage
1	*Indigofera pulchella* Roxb.	Fabaceae	Birhol	Coughs and chest pain	The root is dried, grid into a powder and applied externally in the treatment of chest pains.
2	*Cassia tora* L.	Caesalpiniaceae	Kawaria	Leprosy, ringworm	The leaves and seeds are useful in leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis and cardiac disorders.
3	*Sorghum halepense* L.	Poaceae	Jowar	Blood and urinary disorder	The dry seed boil and take orally for the treatment of blood disorder.
4	*Cassia auriculata* Linn	Caesalpiniaceae	Garmalo	Fevers, diabetes,	Decoctions of roots are used in ailments against fevers, diabetes, diseases of urinary system and constipation.
5	*Lantana camara* Linn	Verbenaceae	Ketak	Itching, flu, colds, coughs and fevers.	The extracts prepared from fresh leaves and flowers are highly effective against itching, flu, colds, coughs and fevers.
6	*Xanthium strumarium* L.	Compositae	Godrian	Perspiration	The leaves and roots are used for their anodyne, antirheumatic, antisyphilitic, It has also used as a liniment on the armpits to reduce perspiration
7	*Aristida funiculata* Trin. & Rupr.	Gramineae	Lapdu	Itching and Skin problem	The paste of leaves used in skin problems
8	*Calotropis gigantea* R. Br	Asclepiadaceae	Aakdo	Fever, rheumatism, indigestion, cough, cold, eczema, asthma,	Traditionally it is used to treat common diseases such as fever, rheumatism, indigestion, cough, cold, eczema, asthma, elephantiasis, nausea, vomiting and diarrhoea, either alone or with other medicines.
9	*Capparis decidua* (Forsk.).	Capparidaceae	Kair, Kerdo	Asthma, rheumatic, stomach disorder, cardiac and gastric	The immature fruits are useful for stomach disorder, cardiac and gastric troubles for both humans and animals

				troubles	
10	*Mimosa pudica L.*	Leguminosae	Reesamani	urinary complaints	Decoction of root is useful in renal calculi and other urinary complaints
11	*Tribulus terrestris* L.	Zygophyllaceae	Adulso	urinary disorders, stomach-ache	Dried fruit powder with cow's urine is given for urinary disorders. The paste of root is good remedy for stomachache.
12	*Asparagus sarmentosus*	Asparagaceae	Shatavari	Nervous disorders, dyspepsia, tumours, scalding of urine, throat infections, tuberculosis, cough bronchitis and general debility	The roots are useful in nervous disorders, dyspepsia, tumours, scalding of urine, throat infections, tuberculosis, cough bronchitis and general debility.
13.	*Murraya Koenigi*	Rutaceae	Mithho Limdo	Aroma and spice	It is used in very small quantity for aroma in food and used for aroma therapy.
14	*Cassia auriculata*	Caesalpiniaceae	Aawal	Rheumatic and skin disease	Leaf paste used to cure Rheumatic and skin disease
15.	*Ocimum basilicum*	Lamiaceae	Damaro	Rheumatic and skin disease	Leaves and stems give a delicate flavour to oil. Basil combines well with olive oil and lemon. Basil is said to help treat migraines, digestive difficulties and insomnia.
16.	*Ocimum sanctum* Linn	Lamiaceae,	Tulasi	Colds, headaches, stomach disorders,	Leaf extract is mixed with hot water and given to children suffering from cough cold and fever.
17.	*Parthenium hysterophorus* Linn.	Asteraceae.	Kamboi	Skin diseases.	Leaves used to cure skin diseases.
18.	*Digera muricata* (L.)	Amaranthaceae	Kanajaro.	Digestive system disorders	Leaves and young shoots of *D. muricata* are locally used as a vegetable and given to relieve constipation. Boiled root infusion given to mother after child birth for lactation purpose.
19	*Solanum incanum* L	Solanaceae	Dhubli	Diarrhoea, Fever and Dysentery	Fruits used to cure Piles, diarrhoea, fever and dysentery

evidence to show that their abundance is recorded through an expression of favourable monsoon climate. Grasslands and grasses are helpful in soil conservation (Gould, 1968). The livelihood and lives in both the forest divisions resolve around the genetic wealth which they possess extensively and intensively. The results of the present study also reveal that knowledge about the edibility, habitat destruction and use of most wild plant species is still maintained among the local communities. Floristic structure and composition of the Godhra and Baria forest divisions in Gujarat is mixed type vegetation in nature. Higher values of the density suggest that the forest stands are younger and mature. High density suggests that the diversity and luxuriance of these community forest stands may be maintained in healthy state provided the extent of biotic pressure could be maintained to an optimum limit. The distribution pattern (A/F) ratio showed it as the contagious pattern. In the present study, the higher percentage of *Calotropis gigantea* and *Cassia tora* were recorded in the study area because Godhra falls under a semi arid zone of Gujarat. The use of these weeds by the local communities in different ailments for medicinal purposes shows that people are now adopting with these floras and also using them in their day-to-day life.

Conclusion:

The present study witnessed a variety of ecological problems (like rainfall and temperature) in Godhra and Baria forest divisions due to invasion of many weeds in forest area, in open pockets and grazing lands. In contrary, agricultural diversity have not been affected by weed threat and obtained sustained agro-biodiversity. The preservation of this knowledge will be useful for continued reliance of local communities on most of the medicinal invasive weeds. The result also reveals that many wild species are under growing pressures from various anthropogenic factors. Thus, public awareness and community based management need to be encouraged at all levels since they are also used for medicinal application. However, from the ethnobotanical study it is concluded that the tribal community of the study area use weeds in their daily life. Therefore, there is a great need to conserve the forest resource both at micro and macro level for sustainable development of environment and human wellbeing. Further, awareness among the villagers is essential for sustainable utilization of forest resources for years and generation to come.

Acknowledgements:

The authors are grateful to the Director, Indian Institute of Forest Management (IIFM), Bhopal for providing the opportunity and constant support. The authors are also thankful to all the local people and officials of the Gujarat Forest Department and the selected sample members of JFMCs in Godhra and Baria Forest division for their immense cooperation and active participation. The University of Haramaya, Ethiopia is also acknowledged for their encouragement.

Authors' contributions: Dr. L.S. Kandari (Assistant Professor) has perform the experiment and data analysis, writing the menuscript and also corresponding author; Dr. R. Hiranmai Yadav, Dr. Abhishek Chandra, Dr. Tripti Negi and Dr. P.C. Phondani have contributed in editing and analysis of data of the manuscript.

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